

## East Slope Sierras Precipitation and Flooding of 1997

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Before I start off, I'd like to acknowledge a few folks that have helped put together some of the data that I'm going to be presenting today. Western Regional Climate Center in Reno; Nevada Division of Water Planning, specifically Gary Horton; USGS - I've taken some of their data for streamflows; Gary Barbato down here in Reno with the National Weather Service, who put together some information that I'll be giving this morning.

A little bit of background: I don't think most of you know who I am. I do work for the Natural Resources Conservation Service as a hydrologist. I run the snow survey and water supply forecasting program for Nevada and Eastern Sierra. Western Nevada does get the vast majority of its water from California.

I'm going to do a couple of things this morning. I'm going to give some information on precipitation amounts, snowfall amounts, damages, etc., and then I've got some videotapes on the actual flooding in Nevada. I'm going to primarily be talking about the Tahoe, Truckee River, Carson, and Walker River Basins. Those are the major ones over on our side.

A little bit of a personal insight into this: before Christmas, we were primed and set up for a flood situation. We get our primary floods over on that side from rain-on-snow events. We received between one to three feet of snow in the valley floors just before Christmas, with the Sierras receiving anywhere from six to eight feet. That absolutely paralyzed some of the Sierras. It shut down roads for a couple of days. We had a friend down for Christmas that could not get back up to South Lake Tahoe to her house. It was several days before she could get back home.

By the end of the Christmas season, we were looking at, from the Weather Service forecast, very warm storms coming in. I personally live in the Gardnerville area, which is about 45 miles South of Reno. On January 1, New Year's Day, it was obvious that the storm had hit. Tremendous amounts of rain were coming down. We were getting calls at our home from Douglas County officials wondering what was going on, what kind of information we could provide them.

I believe this was the first time the INTERNET really came into play in tracking storm and flood events. We had been sitting there at our house tracking USGS streamflow over the Interment, and tracking our SNOTEL(Snow Telemetry) data which measures snow fall, rain, and temperature. At that time, about midday on January 1, we got a request to see if we could up our polls on our SNOTEL data from 4 times a day to hourly polls. Fortunately, I was able to get hold of a person up at Portland that could remotely reprogram these sites to give us data on hourly polls. In other words, once every hour, that data was coming in on an almost real time basis. After that, I notified people in the Carson, Truckee, and Walker River Basins that this information was available.

This was particularly important on the Carson River System where several of the stream gauges were washed out. This left the Douglas County officials scrambling for data to look at to try and gauge the storm's impact and plan for downstream flooding. They would call me to try and track it with the SNOTEL data, and basically we were telling them, "Yeah, I think the flood is coming," and indeed it did.

It isolated Gardnerville for a couple of days. It closed down 395, closed down 88. It closed down 395 south of down eventually and down through Wilson Canyon into Yerington. I remember being in the store a couple of days into the storm, overhearing the Produce guy saying, "This is the last of the produce they were putting out at Raley's at that point, and it was going to be a few days before they got trucks in."

Anyway, it was interesting. As was spoken this morning, "I love floods too". It gets me going. My wife gets neglected, my dogs don't get fed. I mean it's exciting. It's really exciting.

I have a few overheads here that I may cut a little short. I think I have too many for the time.

I want to start off with looking at the overall year quickly, as far as precipitation and snow pack goes. It's been mentioned before, this was an oddball year. We got hammered in December and January with precipitation. This is Lake Tahoe Basin right here, and I'll go down through the other basins later. Tahoe received between 300 to 350 percent of average for December and January. Then it dropped off to almost nothing in February, March and April. The percent of average for the water year still remained high because of those months, which really played havoc with trying to forecast streamflow runoffs there.

Again, this is Lake Tahoe. For the snow pack, you can see that the middle line is this year's; the maximum percent of average and then the minimum are the top and bottom lines. We near 200 percent. By the time May 1 came around, we were down to about 60-70 percent of average for snow pack.

I'll just quickly go through the other basins. Truckee River Basin: precipitation again coming close to 400 percent in December. January backed off down to just less than 300 percent, and then again February and March had just a trace. We went out to do our snow surveys on February 1. We went back into two of the sights on March 1 and could see out footprints going in from the month before. We had maybe gotten only about 4-5 inches of snow that month.

The snowpack began around 200 percent plus, gained a little bit in February, and then just dropped off.

I'll quickly go through the Carson. Again, the same type of pattern, very little in February and March, with December and January providing the year's snowpack. the snowpack dropped off in this case to below average for both April and May. We were forecasting almost 200 percent of average streamflow in January and February. By the time it got down to March, April and May, we were down to average conditions.

Walker River picked up precipitation at almost 400 percent of average for the month of December. It's a higher elevation site and was picking up more of the snow. January again, saw about 340 percent and then again, dropped back off for the remainder of the winter. The snow pack actually set a record in the Walker River. You can see where it bumps up to about 240

percent, crosses a line and drops back down. Our forecast were originally forecasting record flows on the Walker River.

Some of the information on snow pack and what happened to the snow pack has already been discussed. I'm going to go through some of our SNOTEL sites, from the North to the South to show this point. Echo Peak is up in the Tahoe Basin, you can see this is from 12/15 to 1/15 - a month's worth of data- and you can see the snow accumulating. It actually dropped off on January 1 a little bit, and then came back up and then recuperated by the end of the time period here with this burst of rain. You still got a little bit of snow melt, but it pretty much either just passed on through the snowpack or was absorbed a little bit of that rain that came through.

Fallen Leaf, which is at lake level, is a little bit of a different story. It's got a gap of a couple days there, but again, you can see the snowpack at January 1, and then it just completely melted off.

Squaw Valley, this is the one that had the most rainfall in our sites. This record right here, which is precipitation, is obviously in error. I actually went in on Christmas Eve to repair the site. That's why the data jumps like it does. You can see the tremendous amount of rain, and then the slight melt-off from the snow, and then gradual back-accumulation on the snow pack up at Squaw Valley. That's at 8200 feet, almost at the top of Squaw Valley Ski Area.

Again, Independence Lake up in the Truckee River, shows the same type of thing. This is a high elevation site at 8450 feet. The snowpack saw no real drop off, but pretty much just either absorbed or passed the water on through, even with the tremendous rain-on-snow event that we received January 1.

We'll go to Spratt Creek, which is right behind Markleeville, another low elevation site at 6200 feet. Again you can see the snow pack building up just before Christmas, coming right along, and then melting down. It's missing a couple of days here, but you can see where the precipitation would obviously jump up on January 1, and then level off for the next few days.

This is an interesting slide here. This is Leavitt Lake, at 9400 feet. The precipitation is actually less, or showing up as less than the snow, which is just a catch-characteristic of the precipitation can up there. But you can actually see a one day drop off, quite a bit in the snowpack at Leavitt Lake, and then an immediate gain with probably slightly cooler temperatures, and then a leveling off of the snowpack.

I think maybe what's a little more interesting is what's been called composition. Total available runoff, which has been touched on, for some of the same sites just discussed. Echo Peak, this is for the period 12/30 to 1/6, had a total of 15.8 inches of precipitation. The snowpack lost an inch and a half, and so 17.3 inches was available for runoff. Fallen Leaf Lake, again 11.8 inches within that week period, and most of this was focused around 2-3 days. A loss of a little over 5 inches from the snowpack for 17 inches of runoff. Here's Squaw Valley: 22.3 inches of precipitation, a loss of about 2-1/2 inches, for total runoff of 25. Independence Lake, the same type of thing. This is repeated up and down the Sierras here.

Then you get to some of these sites that basically lost none of the snowpack at all. Leavitt Lake had 15.4 inches of precipitation, but the snowpack actually held 6-1/2 inches of that, for 8.9 inches of runoff. And so, in the higher elevation, the snowpack actually acted as a sponge in that situation, and held that water in place.

Let me quickly go through some of the USGS streamflow, and then I'll get to the videos, which are probably the most interesting. The Truckee River at FARAD, which is at the state line, was at about 15,000 cubic feet, and then dropped back off within the first couple of days of January. Nixon, which is downstream from the Reno/Sparks area, actually had a much higher peak. A good part of that flow is from Steamboat Creek which flows into the Truckee River just east of Sparks.

One of the interesting things about the flood coming through the Reno area is that it's been calculated by the USGS and by Gary Stone, Federal Water Master, that it would have been easily over double the flow through the Reno area if it hadn't been for upstream reservoir storage. I believe the USGS has calculated this as being about a 50-year flood event through Reno, if you didn't have the upstream storage, it would have been well over the 100-year flood.

The Carson River had a flow over 22,000 cfs at the Markleeville gage which was actually washed out during the storm. This broke the record for both stage and streamflow. The West Fork of the Carson, by Woodfords actually moved over about 100 yards, changed channels and left the gauge high and dry. This was well over the 100 year flood.

The West Walker near Coleville, which is up in Antelope Valley, had about 12,000 cfs, which took out the gauge and set records for stage and flow. Highway 395 through the canyon was closed down several months for repairs.

There were lesser flows on the East Fork of the Carson river, but again, a peak flow of nearly 4,000 cfs broke records.

Some of the damages that were done on the East side, both California and Nevada, had about a billion dollars in value. We had two people lose their lives; one in Gardnerville who was working on a trailer park on the East Fork of the Carson. He was trying to shore the bank up. The river had eroded the bank away. The undercut bank gave way and he and his machinery fell into the river. His equipment was found a couple hundred yards downstream. His body has still not been recovered. Another person in Sparks was believed to be swept away. It was thought that he went into his place of business. The road access in there had been washed away. He was never seen of or heard of again and is believed to be washed down the Truckee River. Both bodies are still missing at this point.

I think now I'd like to go ahead and run a couple of videos. A number of about 6-8 companies, both news and private, have put together videos of the flooding. I've got three short clips that I'd like to show of the Truckee, Walker, and Carson River damage.  
(Videos running with audio)